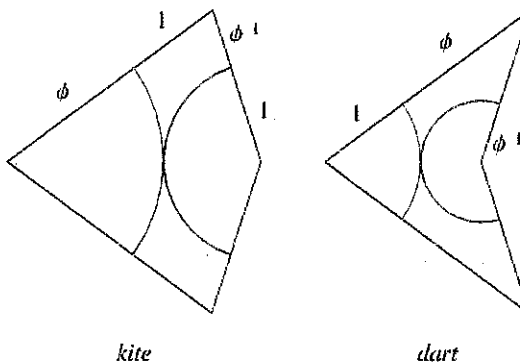
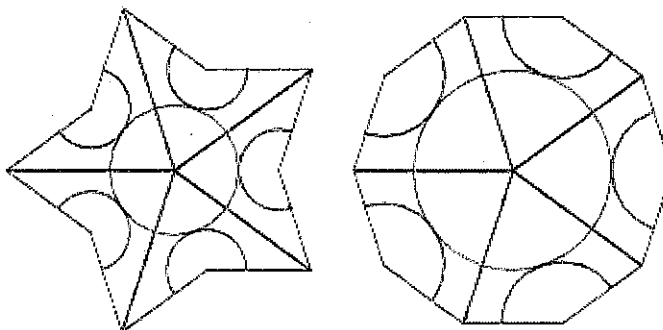


Penrose Tiles

They were invented in 1974 by Roger Penrose, a British scientist. The shapes were named "kites" and "darts" by John Conway, a mathematician at Princeton University. These tiles have many amazing properties. For one thing, they are non-periodic. You can tile forever with them, but if you trace your tiling on tracing paper, you can't slide the tracing paper and make it match up. The best way to begin to understand them is to play with them!



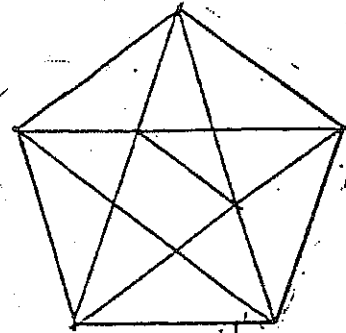
Make a bunch of tiles on card stock, using the pattern given. Color the arcs blue and red so you can use your tiles with other students. Put your name on the back of each tile. As you tile, your pieces must touch, edge to edge, and the colors must match up. If you reach a place where no tile fits, take a few tiles off and try again.



- 1) Create a beautiful Penrose tiling!
- 2) Are there more kites or darts in your tiling? What is the ratio of kites to darts?
- 3) What happens to the colored curves in your patterns?
- 4) How many ways can you tile around one point?
- 5) What are the angles in each shape? What is the ratio of the longer side to the shorter side of each?

6) Use a ruler, compass and protractor to draw a neat kite and dart "from scratch." Make the smaller sides 3 inches. How long will the longer sides need to be?

6) Can you find the kite and dart in this drawing?



7) How could you tell someone, using only words, how to draw the two shapes?

8) No Penrose tiling has translational (sliding) symmetry. But can you make tilings with rotational or reflectional symmetry?

9) Explain, with examples, the differences between periodic and non-periodic tilings.

10) Research more about Roger Penrose and the Penrose tiles? About other tilings? Record what you find out.

11) Invent a new tile or tiling.

12) Have fun!

Five kites and three
darts in a possible
tiling. Color the
center circle red, &
the three outer arcs
red. The rest
of the arcs
are blue.

